

Three species of toxic sponges from Cebu, Philippines (Porifera: Demospongiae)

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Abstract.—Three species of sponges toxic to hard corals are described from Mactan Island, Cebu, Philippines. They were most common at depths of 8–12 m, but they occurred between 3 and 32+ m. *Plakortis lita* forms thick crusts or is subglobular or massive and liver brown. Diodes are very densely packed and irregularly distributed. Triodes are rare and microrhabds absent. *Acervochalina hooperi*, new species, forms thin crusts and is dark green. Thick branching spongin fibers are embedded with small oxeas. *Xestospongia vansoesti*, new species, forms thick crusts but can be digitate, and dark green to black. Dense multipictrular tracts contain oxeas. The sponge produces a copious brown mucus.

Since 1994 we have been periodically studying the coral reef community and specifically the sponges of Cebu, Central Philippines. Nishiyama (Nishiyama & Bakus 1999) discovered that all three species of sponges described below were releasing allomones into the surrounding seawater. These allomones were toxic to some hard corals which suggests that the sponges and hard corals are competing for space. Thus, sponge toxins may play an important role in the structuring of coral reef communities. We are herein describing these species of sponges from our ecological field studies.

Materials and Methods

Site description.—Our study site is located approximately 200 m off the Tumbuli Beach Resort on the east coast of Mactan Island near Cebu City (10°17'N, 124°E) (Fig. 1) (Bakus and Nishiyama 1999). Depths surveyed were 3–32 m. The area has a narrow intertidal region followed by seagrasses (principally *Thalassia hemprichii*) to a depth of 5–10 m, then a rich coral reef community to a depth of at least 40 m, with the slope becoming steeper beyond a depth of 20 m. The dominant hard corals in

the region include *Acropora*, *Pocillopora*, *Seriatopora*, *Tubipora*, *Halomitra*, *Parahalomitra*, *Lobophyllia*, *Symphyllia*, *Euphyllia*, *Pectinia*, *Porites*, *Montipora*, *Milepora* and *Fungia* (University of San Carlos Marine Biology section 1979). The average current velocity at the study site was 0.09 m/sec although flow rates as high as about 3.9 m/sec (2 knots) occur occasionally during shifting tides. Current direction during our June–July studies was from 60° NE or 220–240° SW, depending on the tides. The water temperature was 28–31°C although it can get as low as 26°C in February (F. Sotto, pers. comm.). Underwater visibility was 15–30 m. The three species of sponges occurred at depths of 3–32+ m. They were most common at depths of 8–12 m.

Sponges were collected in the field by hand, frozen in a –30°C freezer, and studied later in the laboratory. Scanning electron micrographs (SEM) of spicules were made with a Cambridge 360 SEM. Spicules were measured with a Zeiss Compound Microscope fitted with an ocular micrometer. Sponge skeletons were digitized with a RCA TC 1005 camera connected to a Data Translation 3155 frame grabber board in a

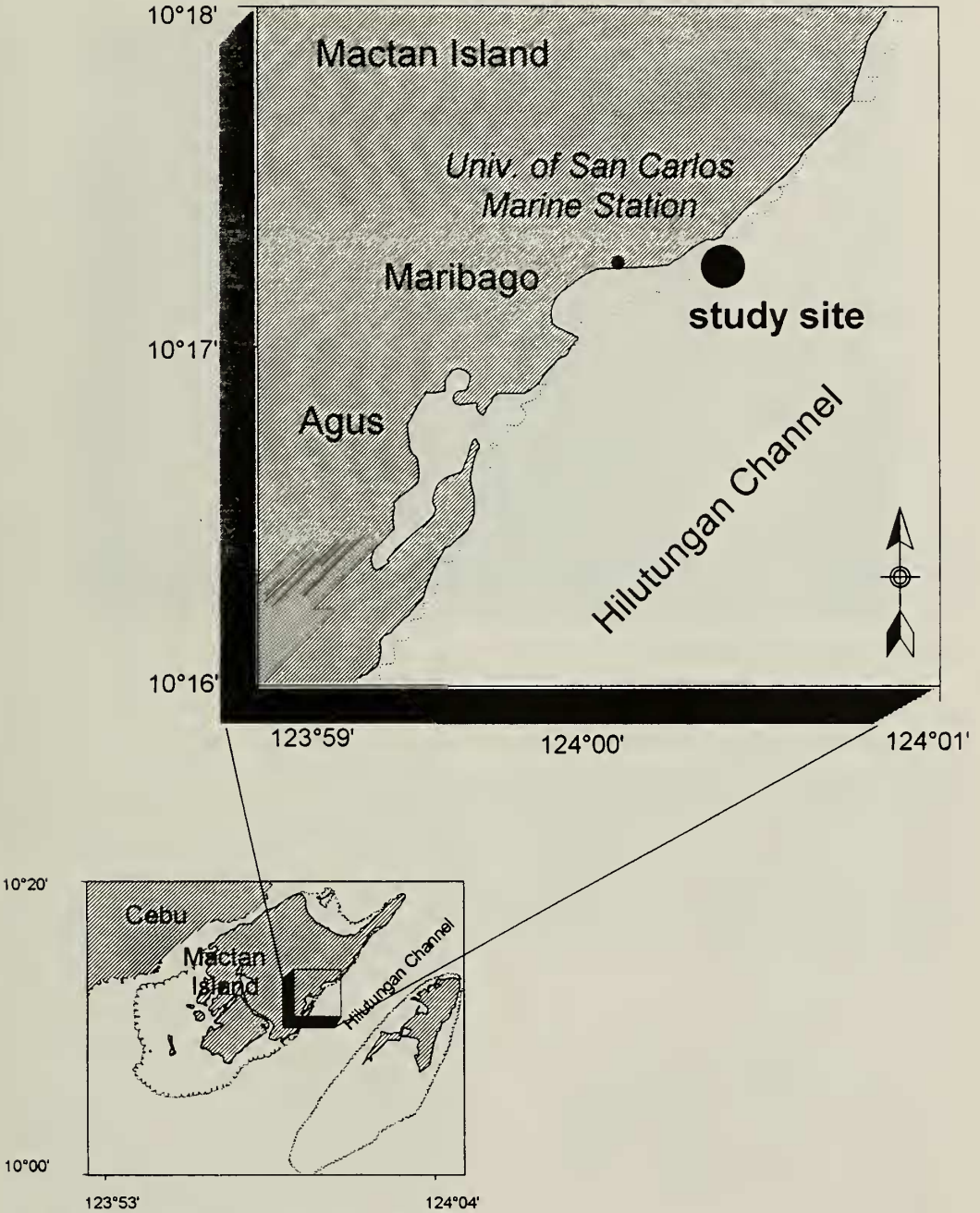


Fig. 1. Mactan Island, Philippines, and study site.

PC computer with an Intel Pentium 233 microprocessor. Current velocities were measured using Rhodamine B dye; nine measurements were made during three days. Current direction was measured using a

compass; three measurements were recorded on each of five days. Water temperature was measured with a scuba regulator thermometer. Water visibility was estimated using a transect line. The GJB-95 series of



Fig. 2. *Plakortis lita* on dead coral.

sponges are deposited in the University of San Carlos marine biological collections, Cebu City, Cebu, Philippines and the holotypes and paratypes are lodged in the collections of the National Museum of Natural History, Washington D.C. (USNM), and the British Museum of Natural History, London (BMNH), respectively.

Species Descriptions

Order Homosclerophorida
 Family Plakinidae Schulze, 1880
 Genus *Plakortis* Schulze, 1880
Plakortis lita de Laubenfels, 1954
 Figs. 2–4

Material examined.—GJB-95-1 and two additional specimens, USNM 51497 and BMNH 1999.1.21.3.

Description.—Thickly encrusting to submassive to globular (Fig. 2). Sponge dimensions are presented in Table 1.

Color.—Dark brown (similar to liver) live and preserved.

Odor.—Similar to old aquarium water. No terpenoid odor.

Texture and consistency.—Firm but rubbery. No tendency to disintegrate in alcohol.

Surface.—Smooth, velvety, with scattered oscula, sometimes with a raised membranous lip. Oscula approximately 1 mm in diameter. No oscula were observed in preserved specimens. Pores 31–62 μm in diameter. Numerous strongly pigmented cells. Ectosome not detachable. No mucus.

Skeleton.—Diodes are very dense and irregularly distributed throughout the sponge. Scanning electron micrographs of spicules are presented in Fig. 3 and spicule measurements in Table 2. Digital photos of the skeleton are presented in Fig. 4.

Mesohyl and canals.—Canals <250 μm in diameter. Very small diodes are numerous. Brown pigmented cells are abundant and characteristic.

Biological associates.—None observed with a dissecting microscope.

Table 1.—Dimensions of three sponge species based on field measurements from Mactan Island, Cebu, Philippines.

Species	<i>n</i>	Median	Mean	<i>SD</i>	Minimum	Maximum
<i>Plakortis lita</i>						
Length (cm)	27	13	18	14.8	5	77
Width (cm)	27	9	12	7.6	2	32
Height (cm)	27	3	3	2.2	1	10
<i>Acervochalina hooperi</i> , new species						
Length (cm)	14	13	14	9.1	3	30
Width (cm)	14	8	9	6.7	2	23
Height (cm)	14	0.2	0.2	0.1	0.1	0.5
<i>Xestospongia vansoesti</i> , new species						
Length (cm)	23	13	19	25.5	5	131
Width (cm)	23	8	12	14.7	2	75
Height (cm)	23	3	4	4.4	0.7	20

Discussion.—Initially only diods were found in microslide preparations. A careful re-examination of the spicules indicated that the sponge contained rare triods but no microrhabds. Moreover, the diods did not have three bends as described by de Laubenfels (1954) in *Plakortis lita* from Truk and Ponape. The diods looked like slightly malformed oxeas and were irregularly distributed. Our sponges are closest to *P. lita* yet lack several of its major characteristics. Diaz and van Soest (1994) reviewed the systematics of the Plakinidae. They described some specimens of *P. lita* with a terpenoid odor and the tendency to disintegrate in alcohol. Our specimens lack these characteristics. Diaz & van Soest (1994) concluded that the variable presence of microrhabds in type specimens of *P. lita* casts doubt over the conspecificity of all reported specimens. They may be part of a *Plakortis* superspecies complex. Because our sponges look like *P. lita* (identified by Kelly Borges) in Colin & Arneson (1995), we are using that name tentatively for our sponges.

Order Haplosclerida

Family Chalinidae Gray, 1867

Genus *Acervochalina* Ridley, 1884

Acervochalina hooperi, new species

Figs. 5–7

Type material.—Holotype: USNM 51495. Collected at 10 m depth off Mactan

Island, Cebu, Philippines, in June 1998. Preserved sponge dark brown, thinly encrusting on most of a dead branching hard coral measuring 11 × 7 cm. Paratype: BMNH 1999.1.21.2.

Material examined.—GJB-95-3, Holotype, paratype and live specimens.

Diagnosis.—Thinly encrusting and dark green, compressible, scattered oscula with membranous lip. Thick branching and anastomosing spongin fibers with embedded small oxeas.

Description.—Thinly encrusting, up to 5 mm thick on dead coral (Fig. 5). Sponge dimensions are presented in Table 1.

Color.—Dark green live. Dark brown after long exposure to air. Dark green to black preserved.

Odor.—Similar to freshly cut grass that has been in water for a day.

Texture and consistency.—Velvet-like, soft, compressible.

Surface.—Superficially undulating, fibrous under dissecting scope. Dermal membrane is often missing in collected specimens; where it occurs in these specimens it generally lacks spicules. Oscula round, about 2 mm in diameter, scattered, often with a raised membranous lip in the field. No oscula observed in preserved specimens. No mucus.

Skeleton.—Ascending fibers with embed-

Table 2.—Spicule dimensions for three species of sponges from Mactan Island, Cebu, Philippines.

Species	<i>n</i>	Median	Mean	<i>SD</i>	Minimum	Maximum
<i>Plakortis lita</i> (GJB-95-1)						
Diod Length (μm)	20	109	110	9.1	90	148
Diod Width (μm)	20	4	3.7	0.4	1	4
<i>Acervochalina hooperi</i> , new species (GJB-95-3)						
Oxea Length (μm)	20	111	113	11.9	86	137
Oxea Width (μm)	20	4	4	0.5	1	5
(Holotype)						
Oxea Length (μm)	20	113	111	11	78	125
Oxea Width (μm)	20	6	5	1.6	3.1	7.8
<i>Xestospongia vansoesti</i> , new species (GJB-95-30)						
Oxea Length (μm)	20	242	240	21.1	152	279
Oxea Width (μm)	20	11	11	0.9	2	12
(Holotype)						
Oxea Length (μm)	20	269	266	27	191	300
Oxea Width (μm)	20	13	13	1.7	11	16

ded oxeas arise from a coral base. Some ascending fibers approximately 250 μm apart measure 62–123 μm at the base then gradually taper towards the upper end until

about 30 μm in diameter at which time the fibers splay out slightly (about 400 μm below the surface). Other fibers have variable diameters (e.g., 15 μm to 45 μm to 30 μm)

Fig. 3. Diod from *Plakortis lita* SEM (X1230).

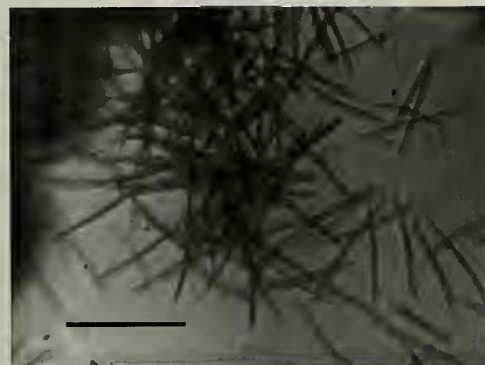


Fig. 4. Digital photos of the choanosome of *Plakortis lita* showing the diods in confusion. The bars are 100 μm long.

as they ascend. The fibers are echinated occasionally or densely by oxeas (not localized) and are light to medium brown preserved. Most fibers branch or anastomose but single fibers occasionally occur. The mesohyle appears to have few or no oxeas. Scanning electron micrographs of spicules

are presented in Fig. 6 and spicule measurements in Table 2. Digital photos of the skeleton are presented in Fig. 7.

Mesohyl and canals.—Mesohyl is sparse to absent. No canals were observed.

Biological associates.—None observed with a dissecting microscope.

Discussion.—Rob van Soest (pers. comm.) tentatively called this species *Acervochalina* aff. *confusa* Dendy, 1922. However, *A. confusa* is described as being erect or pendant with cored fibers 20 μm in diameter. Our specimens are most closely related to *Acervochalina* (*Cacochalina*) *mollis* Topsent, 1897 from which they differ by their thinly encrusting habitus, dark green to black color in alcohol, thick spongin fibers and small oxeas. We name it *Acervochalina hooperi*, new species, in honor of Dr. John Hooper who has contributed greatly to sponge systematics.

Order Haplosclerida

Family Petrosiidae van Soest, 1980

Genus *Xestospongia* de Laubenfels, 1932

Xestospongia vansoesti, new species

Figs. 8–10

Type material.—Holotype: USNM 51496; Collected from a depth of 10 m off Mactan Island, Cebu, Philippines, on 24 Jul 1996. Preserved sponge dark brown, slightly digitate, on dead coral measuring 9 \times 5 cm and 3 cm thick. Firm, crusty. Paratype: BMNH 1999.1.21.1.

Material examined.—GJB-95-30, Holotype, Paratype and live specimens.

Diagnosis.—Thickly encrusting to digitate, crusty. Dark green to black with copious brown mucus production. Oscula 1–2 cm apart. Dense meshwork of multispherical tracts of oxeas. Spongin sparse.

Description.—Thickly encrusting to digitate (Fig. 8). Sponge dimensions are presented in Table 1.

Color.—Dark green to black live and preserved. The sponge produces a copious brown mucus when handled and especially when damaged. Some untouched specimens



Fig. 5. *Acervochalina hooperi*, new species, on dead coral.



Fig. 6. Oxea from *Acervochalina hooperi* n. sp. SEM (X1080).

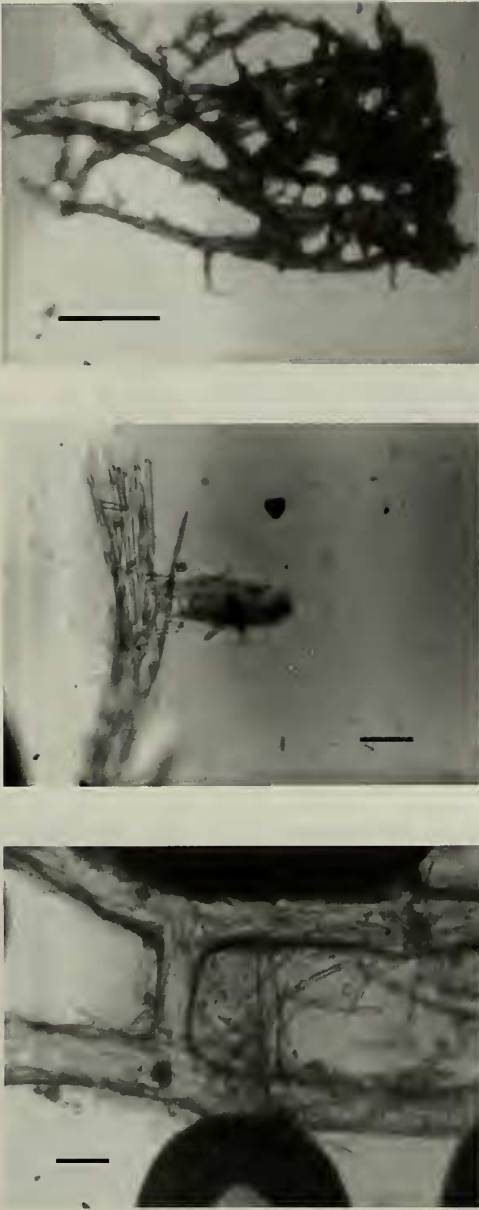


Fig. 7. Skeletal fibers of *Acervochalina hooperi*, new species. The skeleton is shown in the upper photo with the base of the sponge on the right and the upper part of the sponge skeleton on the left. The bar in the upper photo is 500 μm long. The bars in the lower two figures are 100 μm long.

in the field had strings of mucus trailing from the sponge. The alcohol in which they are preserved turns a dark coffee color.

Odor.—Similar to smoke from fireworks.

Texture and consistency.—Rough to the touch, crusty, hard, incompressible.

Surface.—The intact surface is smooth but the dermal membrane is often missing. When missing, the sponge is microrugose with fibers extending upwards, up to 1 mm. The oscula are common, 1–2 cm apart, flush with the surface, and measure up to 3 mm in diameter. Pores are abundant and measure up to 250 μm in diameter. Spicules are generally lacking in the dermal membrane. Numerous, very small subdermal spaces occur.

Skeleton.—A dense meshwork of multipiculate tracts, commonly up to 5 spicules or 80 μm thick but sometimes up to 150 μm in diameter. The choanosomal meshes measure approximately 0.5 mm in diameter and the meshes near the surface about 150 μm in diameter. Spongin is sparse. Scanning electron micrographs of spicules are presented in Fig. 9 and spicule measurements in Table 2. Digital photos of the skeleton are presented in Fig. 10.

Mesohyle and canals.—Mesohyle dense, canals moderately numerous.

Biological associates.—None observed with a dissecting microscope.

Discussion.—*Spongia carbonaria* was originally described by Lamarck (1813). De Laubenfels (1936) transferred it to *Pellina* and later described the species from Koror, Palau Islands (de Laubenfels 1954). Hechtel (1965) described it from the West Indies as a new combination, i.e., *Adocia carbonaria*. Bergquist (1965) called her Palau specimens *Pellina carbonaria*. John Hooper (pers. comm.) thought that our sponge was probably a *Xestospongia*, based on a manuscript description. Van Soest (pers. comm.) places our sponge under *Xestospongia* as an undescribed species. A related species, *Reniera viridenigra* Vacelet, Vasseur & Levi, 1976 from Madagascar, differs from our species by having an iridescent green reflection alive, friable consistency, and an ectosome with several layers of a tangential isodictyal network of strongyles with oxete ends. Our species is dark green

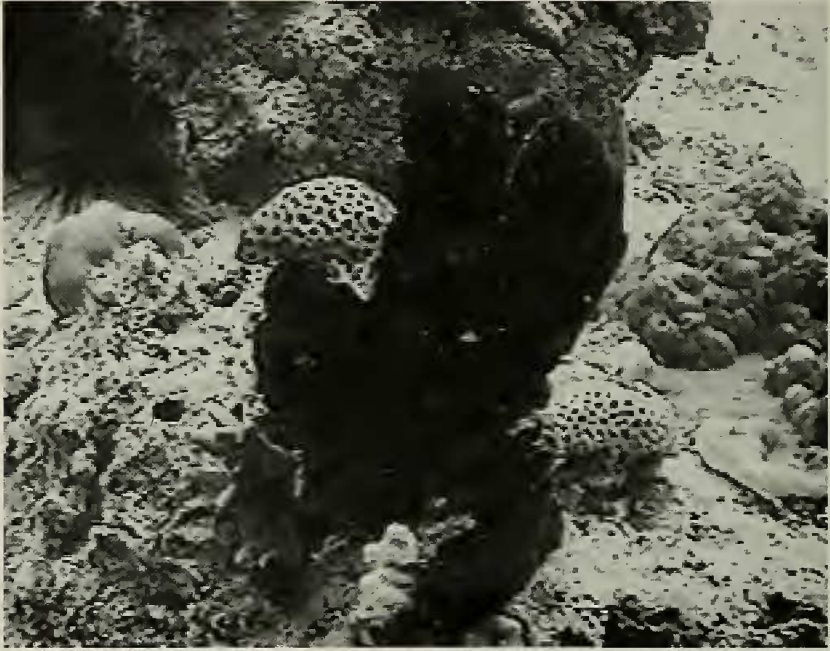


Fig. 8. *Xestospongia vansoesti*, new species, on dead coral.



Fig. 9. Oxea from *Xestospongia vansoesti*, new species. SEM (X470).

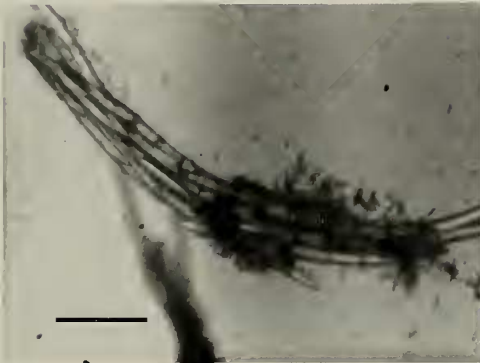


Fig. 10. Skeletal fibers of *Xestospongia vansoesti* n. sp. Note the two pores in the lowest figure. The bars are 100 μm long.

to black and produces a copious brown mucus containing chemicals toxic to hard corals (Nishiyama & Bakus 1999). It is hard, encrusting to digitate (but unlike *Pellina*), and has ascending fiber tracts averaging 80 μm in diameter, but that range up to 150

μm in diameter. Thus it requires a new species name, *Xestospongia vansoesti*, new species, in honor of Dr. R. W. M. van Soest who has contributed greatly to sponge systematics.

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